

We Claim:

1           1. A method for controlling a gap in an electrically conducting solid  
2 state structure, comprising the steps of:

3                 providing an electrically conducting solid state structure including a  
4 gap in the structure;

5                 exposing the structure to a fabrication process environment conditions  
6 of which are selected to alter an extent of the gap in the structure;

7                 applying a voltage bias across the gap in the structure during process  
8 environment exposure of the structure;

9                 measuring electron tunneling current across the gap during process  
10 environment exposure of the structure; and

11                 controlling the process environment during process environment  
12 exposure of the structure based on tunneling current measurement.

1           2. The method of claim 1 wherein controlling the process  
2 environment comprises halting process environment exposure of the  
3 structure based on tunneling current measurement.

1           3. The method of claim 1 wherein controlling the process  
2 environment comprises comparing tunneling current measurement with a  
3 threshold tunneling current corresponding to a prespecified gap extent and  
4 controlling the process environment based on the comparison.

1           4. The method of claim 1 wherein the conditions of the fabrication  
2 process environment are selected to increase an extent of the gap in the  
3 structure.

1           5.     The method of claim 1 wherein the conditions of the fabrication  
2     process environment are selected to decrease an extent of the gap in the  
3     structure.

1           6.     The method of claim 1 wherein the fabrication process  
2     environment comprises ion beam exposure of the structure.

1           7.     The method of claim 6 wherein the ion beam exposure comprises  
2     blanket ion beam exposure of the structure.

1           8.     The method of claim 6 wherein the ion beam exposure comprises  
2     rastering of the structure by a focused ion beam.

1           9.     The method of claim 1 wherein the structure comprises two  
2     electrically conducting electrodes having a gap between the electrodes.

1           10.    The method of claim 9 wherein the electrically conducting  
2     electrodes are disposed on an electrically insulating membrane including an  
3     aperture aligned with the gap between the electrodes.

1           11.    The method of claim 9 wherein the electrically conducting  
2     electrodes are disposed on an electrically insulating surface of a substrate.

1           12.    A method for controlling a gap between electrically conducting  
2     electrodes, comprising the steps of:

3                 providing at least two electrodes on a support structure, each electrode  
4     having an electrode tip that is separated from other electrode tips by a gap;  
5     and

6               exposing the electrodes to a flux of ions causing transport of material of  
7       the electrodes to corresponding electrode tips, locally adding material of the  
8       electrodes to electrode tips in the gap.

1               13.     The method of claim 12 wherein the support structure comprises  
2       a substrate

1               14.     The method of claim 13 wherein the substrate comprises an  
2       electrically insulating surface on which the electrodes are disposed.

1               15.     The method of claim 12 wherein the support structure comprises  
2       a membrane including an aperture aligned with the electrode gap.

1               16.     The method of claim 12 wherein the support structure comprises  
2       a substrate including a trench aligned with the electrode gap.

1               17.     The method of claim 12 wherein the electrodes comprise metal  
2       electrodes.

1               18.     The method of claim 12 wherein the ion flux exposure of the  
2       electrodes comprises blanket ion beam exposure of the electrodes.

1               19.     The method of claim 12 wherein the ion beam exposure of the  
2       electrodes comprises rastering of the electrodes by a focused ion beam.

1               20.     The method of claim 12 further comprising:  
2               applying a voltage bias across the gap between electrodes during ion  
3       flux exposure of the electrodes;

4           measuring an electron tunneling current across the gap, between  
5   electrodes, during ion flux exposure of the electrodes; and  
6           controlling the ion flux exposure of the electrodes during ion flux  
7   exposure of the electrodes based on tunneling current measurement.

1           21.   The method of claim 20 wherein control of the ion flux exposure  
2   of the electrodes comprises halting of the ion flux exposure.